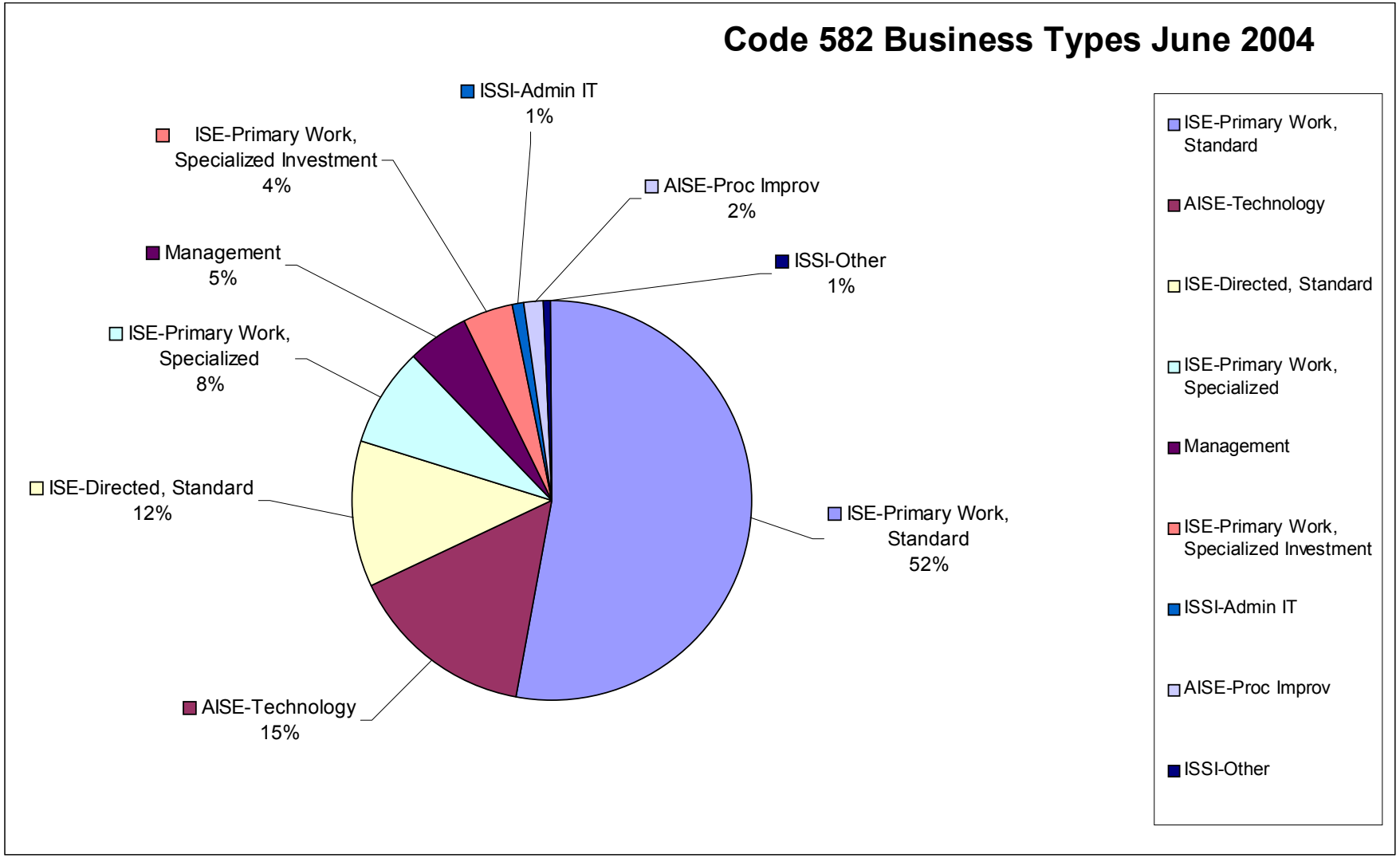
Flight Software Branch
Code 582

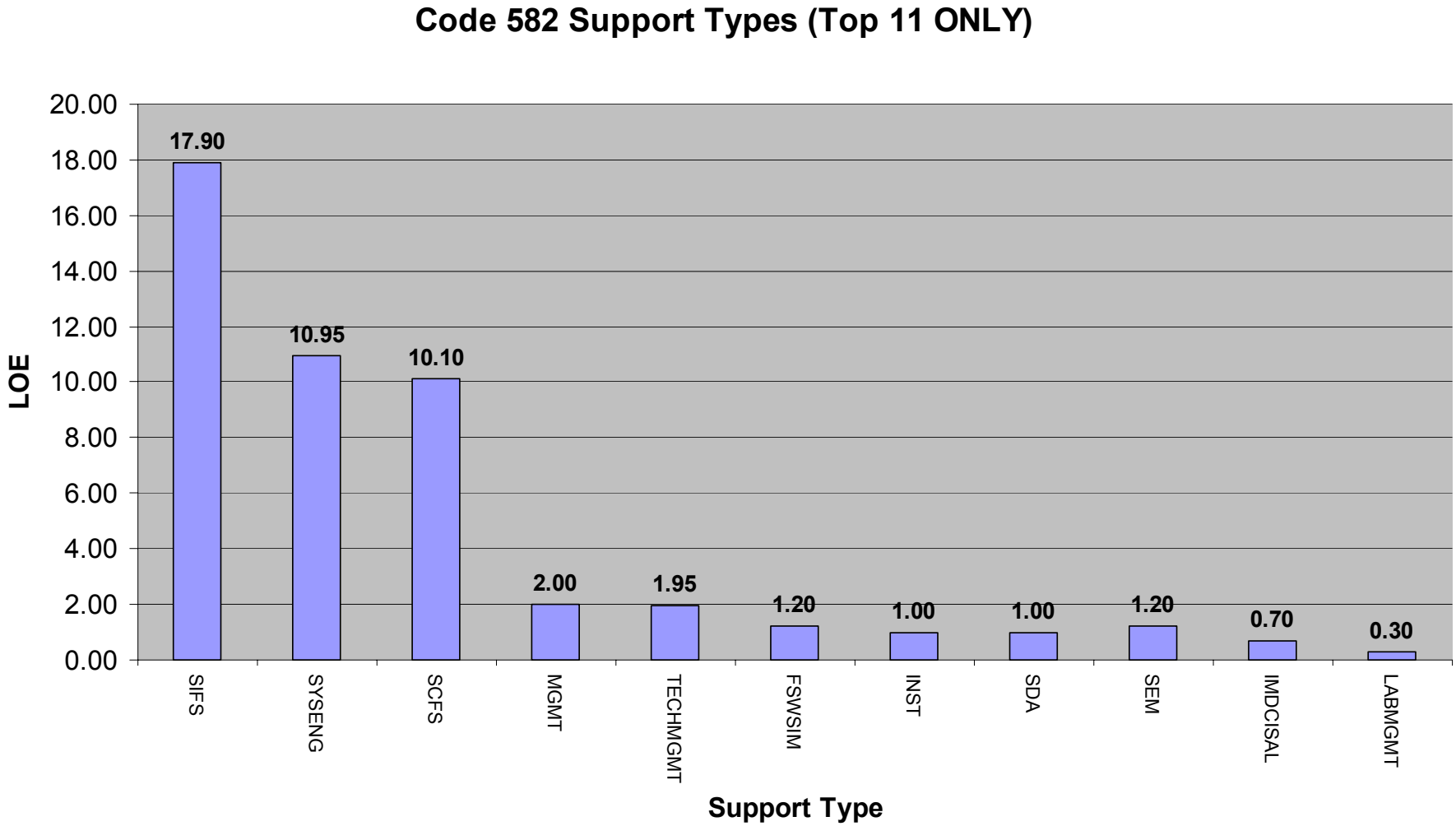
Project Status Review to ISD
June 23, 2004

Elaine Shell, Branch Head
Ray Whitley, Associate Branch Head
Kequan Luu, Associate Branch Head
Ron Zellar, Associate Branch Head

Code 582 Business Types



Code 582 Support Types



Staff Changes since April

	from	to	
Yvonne Lue	new hire	AISE Mission Request	.1
		Process Improvement	.9
Ron Zellar	IMDCISAL	?? (detailed to NEXUS)	-.4
Mark Stephens	BAT	ISE Primary – Std.	.5
Carver Audain	Aura	GPM ISE Primary – Std.	.2

(Assignments for several staff have been confused due to Sr. staff asking for support w/o asking 582 mgmt. Ray, Kequan will work formal plan for the 4 staff involved.)

FSW DEVELOPMENTS

	Apr	May	Jun	ISD Review	CS	CS Chg	SSC	Status
JWST ISIM FSW Development	G	G	G	Sep-01	1	0.0	17.0	* C&DH build #10 (for SIDUs) was begun. SIDU delivery is on schedule for Jan./Feb. to 11 destinations. Eclipse/IGSS will be used with SIDUs. * FSW 'previously known as OPE, ADP' has been redefined & redesigned & agreed to -- greatly simplifying FSW complexity.
ST-5	G	G	G	Oct-02	2.5	0.0	2.0	• FSW ATRR went very well. • New science algorithms. • AT being run with current delivery, will retest new capabilities.
Swift BAT	G	G	G	Jun-02	4.0	-0.5	3.5	* No new FSW issues (B4.2.1) during recent TV retest. * B4.2.2 will include fixes to the limits/safing response table, updates to the software bus tables, 2 changes to science scripts. * SI team just notified FSW team of SD packet drop-out that they've seen for months. Fix is being tested. * FSW Test Lessons Learned will replace FSW Test Results Review. FSW AT Report is being developed.
SDO	G	G	G		6.5	0.0	4.5	FSW PDR moved to August. C&DH: SDN B2.1 is in development; test program moving slowly. GN&C: ACS framework, ephemeris, CSS, IRU data processing are in development. Issues: Too many FSW staff are working multiple jobs. Electronics hardware ICDs are late. GN&C hardware & algorithms will be very late.
GPM	G	G	Y		1.5	0.0	2.0	Space/Ground I/F: Reached agreement on Reliable uplink (COP-1 over IP). Good set of IP Security USE cases has been captured. GN&C: Autonomous Orbit Maneuver requirements progress is excellent. C&DH: Core FSW prototype in Sept. Issues: Staff, Budget, Schedule, Launch date are not in synch. FSW Devel. Labs are to use commercial CPU only!!

JWST Event-driven Science Onboard Scheduling Trade Study

- **Onboard Options considered – Ken Rehm, FSW team, STScI**
  - **Command and telemetry ASCII mnemonic translation**
    - in FSW?
    - using JavaScript?
  - **Observation Plan Executive (OPE)**
    - as separate application?
    - combined with Script Processor?
    - as a JavaScript?
- **Selected Option**
  - **Command and telemetry mnemonic translations in JavaScript**
  - **Event-driven Science Scheduling in JavaScript**

- **Working prototype has been constructed.**
- **Science Institute concurs!**

- **Reduces FSW complexity and cost.**

FSW SYSTEMS MANAGEMENT

	Apr	May	Jun	ISD Review	CS	CS Chg.	SSC	Status
JWST ISIM and SI FSW Management	G	G	G	**Jun-01**	**2**	**0**	**3.5**	* MIRI and NIRCam SI FSW Leads and Lead Developers came for 3 days RR & Core FSW training – big success. * HST Payload contractor added to systems engineering team.
JWST Spacecraft FSW	G	G	G	**Oct-02**	**0**	**0**	**.5**	• CPP interviews for Term completed.
Swift FSW	G	G	G	**Jun-02 Jun-04**	**1**	**0**	**0**	* John Ong reporting today.
SDO	G	G	G	**Apr-04**	**1**	**0**	**0**	GSFC support of FSW given to EVE instrument is being worked.
GPM	G	G	G		**.5**	**.2**	**0**	Hybrid Cost Estimates for FSW only $3M. Being worked.
EOS Aura	G	G	G		**.5**	**-.2**	**.5**	All FSW issues have been closed out. Clock oscillator problem on other s/c is causing strategizing of redundancy issues and FSW patch options to correct the Aura clock once/min.
NPP	G	G	G		**1**	**0**	**.5**	See next page.
GLAST	G	G	G		**0**	**0**	**1.5**	

NPP FSW Sys. Mgmt. Status
(from Lisa Shears)

Due to expected delays (technical and budgetary) in the OMPS and VIIRS instrument flight model deliveries, **GSFC and IPO are in progress of reworking the Project schedule from Satellite I&T through launch** to incorporate an instrument EDU integration risk reduction phase; this will allow later flight model deliveries of the instruments while **maintaining the 10/31/06 launch date**.

NGES completed the assembly and environmental testing of the ATMS EDU instrument. BATC and NGES supported testing of the ATMS Gold Signal Processor Assembly (SPA) with the Spacecraft-Instrument Interface Simulator (SIIS) on May 25-27; the test served its purpose by identifying a problem with a specific ATMS packet (content and generation rate). The **ATMS Software Test Readiness Review was successfully held on June 8, 2004**; the purpose of this review was to assess the results of the flight and ground software test through EDU test. Discrepancies identified through the SIIS and EDU testing will be incorporated into the flight model build of the flight software.

In March and April 2004, IPO and NGST conducted a **Flight Software Assessment (process review and artifacts audit) of the Raytheon SBRS VIIRS flight software and development processes.** Many software development process deficiencies were noted. I reviewed the **results and corrective action being taken and found them comprehensive**.

The **BATC Spacecraft flight software development continues**; modified 1394 System and Technical IRDs were levied on BATC which will result in an additional build of the Flight Software. One more monthly code walkthrough for the first build is planned for July 2004, with a final code walkthrough for 1394 functionality build planned for February 2005. Flight Software Test procedures will be available for review in the July time frame.

The **NGST Flight Vehicle Simulator (FVS) has been identified as a high risk and critical path item for the ground system development.** The FVS is comprised of the BATC-provided Spacecraft Simulator, NGST-provided instrument simulators, and a Raytheon-provided Ground Link Simulator. Although the initial intent of the FVS was to support Flight Ops Team training and operational procedure verification, Raytheon is also relying upon the FVS as a ground system verification tool; the full implications of using the FVS as a verification tool were not adequately addressed by NGST from schedule or resource perspectives. GSFC and IPO/NGST recognize the need to re-assess the FVS from a systems point-of view and plan to assign "Champions" from each organization to help resolve multi-organizational barriers.

IMDC and ISAL

Formal Studies	Apr	May	June	ISD Review	CS	CS Chg.	SSC	Status
IMDC	G	G	G		0.5		0.0	Supported HRV + tbs
ISAL	G	G	G		0.5	-0.4	0.0	Supported 2 studies: LaRC IORIS, ESSP PhyLm (Lidar)

Total IMDC Missions Supported = 51 (since 4/01)

Total ISAL Instruments Supported = 17 (since 12/03)

FSW Proposals

Proposals	Apr	May	Jun	ISD Review	CS	CS Chg.	SSC	Status
GOES ABI	G	G	G		0.1		0.0	Brian Rehm on SEB this month.
OOO	G	G	G		0.0		0.0	Red Team review supported by Lily Bashar
MAGNUS								Red Team review supported by Art Ferrer. FSW replaced by FPGAs. Test environment, test program were missing. Flight FPGAs available much later than we would expect necessary.
LOLA								Use of FPGAs is not understood by 582. **Ron Zellar is new instrument manager!!**
Lunar R					0.0		0.0	No active involvement.
HRV					0.1		0.0	Informal FSW requirements analysis for 486, DM & EM interfaces to 486. FSW being pretty ignored by HRV team. 582 considers FSW near impossible due to schedule, lack of available staff, lack of testbed strategies, ….
LISA	Y	Y	Y		0		0.0	No staff. No activity.
LDCM instrument			G		.1	.1	0	Yvonne Lue working RFP contents for FSW

On-orbit FSW Maintenance

On-orbit: HST, UARS, SAMPEX, RXTE, FAST, TRMM, TRACE, SWAS, WIRE, Terra, MAP, Aqua, ICESat GLAS, Cassini CAPS, Cassini CIRS, (Triana), IRAC

Maintenance Preparations: Swift BAT, Aura, ST-5, TDRSS, MLA

Terra – Ready for AT: ADAC FSW to monitor IRU position and perform attitude "fly wheeling" using ideal commanded rates if IRU problems.
This is in response to an IRU anomaly that caused SafeHold.

Swift BAT - Moving FSW lab to Bldg. 1 on July 12.
Maintenance staff has been actively involved in FSW systems tests, science FSW analysis and BAT tests with the Swift spacecraft.

Several FSW maintenance staff have been assigned to FSW development efforts.

HST Payload

NSSC-1

- completed SITS BL8.4 AP formal test -- Servicing mission all Sis version
- developed plans to increase stored command memory to support HST Life Extension

ACS -- supported operational tests and investigations

STIS -- FSW release in progress for on-board lamp illumination check. Uplink planned late Fall.

NICMOS – To avoid Intel Exception Suspends which have occurred on average 2 per year since 1997 launch, FSW will fix the known PIC (Processor Interrupt Controller) h/w timing problem. Uplink planned early Fall.

COS -- COS FSW training charts completed. No furthur FSW support activity planned.

WFC3 -- - delivered pre-Thermal Vac FSW version. No furthur FSW builds planned (but could be requested to incorporate TV limit patches post TV.

FSW Advances (1 of 3)

Core FSW	Apr	May	Jun	ISD	CS	CS Chg.	SSC	Status
Core FSW Executive (cFE)	G	Y	Y		4.3	0	2	Steady progress on the requirements definition. Prototype effort is verifying some concepts. Schedule and staff assignments don't seem to be firm. Test plan doesn't exist.
OS Abstraction	G	G	G		1.2		1	Coldfire version is working. VxWorks in devel.
cFE AP Plug & Play (GMSEC)	G	Y	Y		0.1		1	Progress very slow with new contractor. Hope to make Sept. schedule.
CCSDS Space Object Interfaces (SOIS) Working Group	G	G	G		.25		0.2	Spring Working Group in Montreal: Jane Marquart: CCSDS Time Critical Onboard Network Services Red Book team made major progress: APIs for services Art Ferrer:; CCSDS Time Critical Onboard Application Services Red Book team worked on standard msg. services and time distribution Trip reports available.
CFDP	G	G	G		1			Tests going well.

FSW Advances (2 of 3)

Onboard Networking	Apr	May	Jun	ISD	CS	CS Chg.	SSC	Status
Ethernet/IP	G	G	G	Dec-03				Reliability tests scheduled to be done by end of June.
MR2								Coordinating plan with hardware folks (Code 561). FPGA component of prototype doesn't support CPUs in the lab.

FSW Advances (3 of 3)

Formal FSW Reuse	Apr	May	Jun	*ISD*	CS	CS Chg.	SSC	Status
FSW Reuse Library	G	Y	Y		0.1	0	0.5	Limited progress due to lack of CS time. Will try to put contractor more in charge.
GN&C FSW Reuse Elements								No activity.
Core Dynamic Simulator								
Core Dynamic Simulator Architecture	G	G	G		0.5		0.2	Only a few software modules remain to be implemented. Integraton test w/ GDS hardware will start soon.
Software-only Dynamic Simulator (GMSEC)	G	G	G		0.1		1	Progressing well!

FSW SPI

FSW CM Plan template	July 2004
FSW Team Status Reporting template	August 2004
FSW Key Trades, Decisions, Cost/Schedule Impacts Log	August 2004
FSW Lessons Learned tool	August 2004
FSW VDD	August 2004
FSW Test Plan and all artifacts	August 2004
FSW Reqmts. template	September 2004
FSW Generic Risks DB	September 2004
FSW Reqmts. Inspection G'lines.	Oct. 2004
Automated Reqmts. Mgmt. implemented on SDO	*Oct. 2004 (process later)*
Design Guidelines template	Oct. 2004
FSW Cost Estimation Guidelines	Oct. 2004
FSW System Test Readiness Review template	January 2005
FSW PDR	January 2005
FSW Test Procedure Style G'lines	February 2005
Automated FSW Test Tracking	tbd
FSW Earned Value Status Tracking and Reporting G'lines	tbd

Acronyms

ACS	Advance Camera for Surveys (HST)
ATMS	Advance Technology Microwave Sounder (NPP)
AXP	Advanced X-ray Polarimeter
BAT	Burst Alert Telescope (Swift)
Cassini CAPS	Cassini Plasma Spectrometer
Cassini CIRS	Cassini Composite Infrared Spectrometer
IC&DH	ISIM Command & Data Handling (JWST)
CCB	Configuration Control Board
CCR	Configuration Change Request
COS	Cosmic Origins Spectrograph (HST)
CPU	Central Processing Unit
DCR	Discrepancy Change Request
DRS	Disturbance Reduction System (ST-7)
EPIC	???
EOS	Earth Observing System
EVE	EUV Variability Experiment (SDO)
FKSI	Fourier-Kelvin Stellar Interferometer
FQT	Final Qualification Test
GLAS	Geo-science Laser Altimeter System (IceSat)
GLAST	Gamma Ray Large Area Space Telescope
GMSEC	GSFC Mission Services Evolution Center
GN&C	Guidance, Navigation and Control
GPM	Global Precipitation Measurement
HST	Hubble Space Telescope
IMDC	Integrated Mission Design Center
ISAL	Instrument Synthesis and Analysis Lab
ISIM	Integrated Science Instrument Module (JWST)
LANL	Los Alamos National Laboratory
LAT	Large Area Telescope (GLAST)
LISA	Laser Interferometer Space Antenna
WMAP	Wilkinson Microwave Anisotropy Probe
MASIS	Monitor & Science Instrument Simulator (HST)
MLA	Mercury Laser Altimeter (Messenger)
MLS	Microwave Limb Sounder (Aura)
MR2	Modular, Reconfigurable, Rapid
NICMOS	Near Infrared Camera & Multi-Object Spectrometer (HST)
NIRCam	Near InfraRed Camera (JWST)
JWST	James Web Space Telescope
NPP	NPOES Preparatory Project
OOO	Organic Origins Observatory
PSU	Penn State University
SAMPEX	Solar Anomalous & Magnetospheric Particle Explorer
RTEMS	Real-time Executive Multiprocessor System
RTOS	Real-time Operating System
RXTE	Rossi X-ray Timing Explorer
SAM	Science Analysis at Mars
SDO	Solar Dynamics Observatory
SEB	Source Evaluation Board
SI	Science Instrument
SICADS	Science Instrument C&DH Simulator (HST)
SI C&DH	Science Instrument Command & Data Handling (HST)
IRAC	Infrared Array Camera (SIRTF)
RW	Reaction Wheel
SA	Solar Array
SEU	Single Event Upset
SITS	Science Instrument Test System (HST & JWST)
SOIS	Spacecraft Onboard Interfaces
SSM	Support Services Module (HST & JWST)
ST-5	Space Technology 5
ST-7	Space Technology 7
STIS	Space Telescope Imaging Spectrograph (HST)
SWAS	Sub-millimeter Wave Astronomy Satellite
TRACE	Transition Region and Coronal Explorer
TRMM	Tropical Rainfall Measuring Mission
UARS	Upper Atmosphere Research Satellite
WFC3	Wide Field Camera 3 (HST)
WIRE	Wide-Field Infrared Explorer
WISE	Wide-field InfraRed Survey Explorer
XRT	X-ray Telescope (Swift)